

SCIURO-HYPNUM CURTUM (BRACHYTHECIACEAE), A NEW RECORD FOR THE MOSS FLORA OF IRAN

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The Hyrcanian Forest is a green belt in the north of Iran, and one of its distinctive features is the presence of an extraordinary variety of moss species. The Brachytheciaceae is distributed worldwide and comprises 62 genera and almost 570 species. *Sciuro-hypnum curtum* is one of the most variable species of the Brachytheciaceae and is here reported for the first time for the moss flora of Iran. The specimen was collected from northern Iran in the autumn of 2018 at an altitude of 581m in the southeast of Rezvanshahr city in Guilan Province. Here we provide description, illustrations, geographic distribution, and the locality and habitat of the new record.

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گونه *Sciuro-hypnum curtum* (Brachytheciaceae) گزارشی جدید برای فلور خزهای ایران

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پهنه رویشی هیرکانی یک کمربند سبز در شمال ایران است و یکی از ویژگی‌های بارز آن تنوع خارق‌العاده گونه‌های خزهای است.
Sciuro-hypnum curtum به‌عنوان یک خانواده پراکنده در سراسر جهان از ۶۲ جنس و تقریباً ۵۷۰ گونه تشکیل شده است.

یکی از متغیرترین گونه های خانواده Brachytheciaceae است، که اولین بار برای فلور خزهای ایران گزارش می‌گردد. نمونه‌های خز از شمال ایران در پاییز ۱۳۹۷ در ارتفاع ۵۸۱ متری جنوب شرقی شهرستان رضوانشهر در استان گیلان جمع آوری شد. توضیحات، تصاویر، پراکنش جغرافیایی و زیستگاه دقیق گونه در مطالعه حاضر ارائه شده است.

INTRODUCTION

The Hyrcanian forests include an important part of the biodiversity of Iran, because of their unique ecological features (Ghahreman & al., 2007). Rezvanshahr City located in the Guilan province, is in an area of Hyrcanian Forests with a high diversity of moss species. Out of 528 species reported in Iran, 123 have been observed in Guilan (Buhse & Boissier 1860, Schiffner 1897-1901-1908-1910, Edw 1920, Frey & Kürschner 1977-1979, Frey 1981, Frey & Kürschner 1983, Kurschner 1996, Kurschner & Akhani 2000, Akhani & Kürschner 2004, Ghahreman & al. 2007, Frey & Kürschner 2010, Zare & al. 2011, Shirzadian 2011, Sharifnia & al. 2012). The study area is surrounded by the Caspian Sea and Talesh County in the north, Masal County in the south, Bandar-e Anzali County in the east, and the Ardabil province in the west (Fig. 1). The area is mainly covered by trees such as *Alnus glutinosa* (L.) Gaertner, *Fagus orientalis* Lipsky, *Carpinus betulus* L., *Quercus castaneifolia* Pant., *Fraxinus excelsior* L., *Tilia platyphyllos* Scop., *Ulmus glabra* Hudson and *Acer velutinum* Boiss. (Naqinezhad & al., 2015).

The Brachytheciaceae belong to the Pleurocarpus mosses and constitute one of the largest families of mosses. It includes around 570 species, 59 of which are present in Iran (Ghahreman & al. 2007, Frey and Kürschner 2010, Kürschner and Frey 2011, Shirzadian 2011; Zare & al. 2011). The genus *Sciuro-hypnum* (Hampe) Hampe consists of around 30 species and is distributed in temperate regions worldwide. *Sciuro-hypnum* was previously included in *Brachythecium* which was recently revised by Ignatov and Milyutina (2007) and Ignatov (Ignatov 2008). So far, five species (*S. reflexum* (Starke) Ignatov & Huttunen, *S. plumosum* (Hedw.) Ignatov & Huttunen, *S. populeum* (Hedw.) Ignatov & Huttunen, *S. oedipodium* (Mitt.) Ignatov & Huttunen and *S. flotowianum* (Sendtn.) Ignatov & Huttunen) of this genus have been reported from Iran (Zare & al. 2011). *Sciuro-hypnum curtum* (Lindb.) Ignatov is one of the most variable species of the Brachytheciaceae (Ignatov & Milyutina, 2007). Here, we report the first find of *S. curtum* from Iran.

MATERIALS AND METHODS

The *Sciuro-hypnum* specimen was collected during research on the bryoflora of northern Iran in November

2018 in a locality at 581 m a.s.l. in the south-east part of Rezvanshahr city in the Guilan Province. The main forest type is dominated by *Carpinus betulus* L. and *Alnus subcordata* C.A.Mey at the sampling location. A voucher specimen is preserved in the Herbarium of the Nowshahr Botanical Garden. The specimens were identified as *Sciuro-hypnum curtum*. We used Smith (2004), Kürschner & Frey (2011), and Kürschner & Erdağ (2005) to identify our material as *S. curtum*. The information on its geographic distribution and exact localities and habitat of the new record are presented in the current study.

RESULTS

A three-year study in the North of Iran led to the finding of a new record species entitled *Sciuro-hypnum curtum* in Iran.

Description of *Sciuro-hypnum curtum* (Lindb.) Ignatov

Medium-sized to robust, in loose tufts, often making extensive covers; dark green, rarely yellowish or brownish-green, glossy. Stems to 10 cm, often flexuose or curved, indistinctly to often distinctly complanate foliate, prostrate, or arching. Stem leaves patent, axillary hairs 2-4-celled, to 120 x 11 μm, loosely arranged, widest at 1/7-1/10 of leaf length, 1.4-2.4 x 0.8-1.5 mm ovate or ovate-triangular, gradually acuminate, rounded to base, with decurrencies proximally broad, but fastly tapered and very narrow along most of their length, slightly concave, not or indistinctly plicate, margins plane, serrulate to serrate; costa weak; laminal cells linear, 7-11 μm, rather thin-walled, basal cells shorter and broader in ca. 3 rows, cells just proximal to decurrency and in the broad proximal part of decurrencies larger than juxtacostal basal cells, 12-18 μm, forming pellucid group that can be quite abruptly delimited or otherwise very gradually transiting to neighboring cells. Branch leaves smaller, ovate, often asymmetric at the base and with margin recurved at the base on one side, acute, narrowly decurrent; costa often ending in prominent spine and sometimes with several additional teeth dorsally, but in some leaves weak, vanished without any spines, margin serrulate to coarsely serrate above; basal cells large. Autoicous; sporophytes frequent. Seta reddish and Capsule reddish-brown, 17-32 mm.

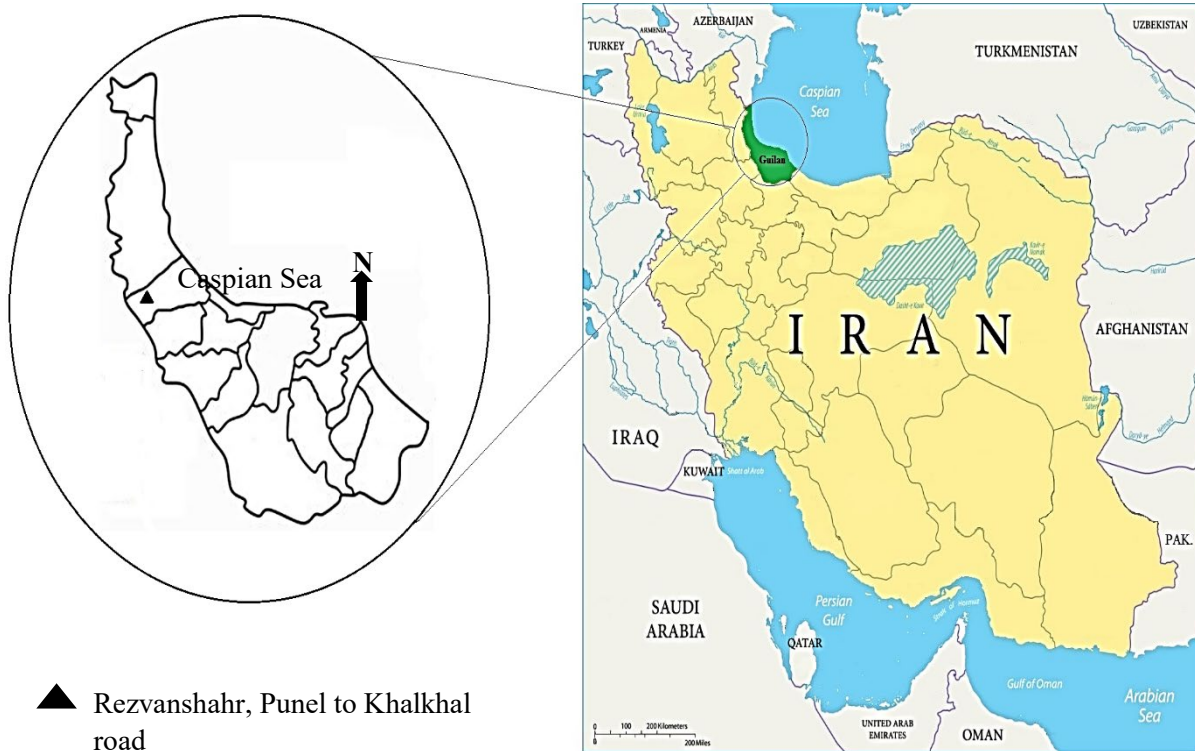


Fig. 1. Location of Guilan province and the sampling region

Specimen examined: Iran, Guilan province: Rezvanshahr, Punel to Khalkhal road, on Stone, 581 m a. s. l., 37° 32' 14".3 N, 48° 53' 07".8 E, 8 November 2018, S.S. Seyed Mousavi & F. Mohammadzadeh; 1865.

Ecology: *Sciuro-hypnum curtum* was collected on a stone and was accompanied by the bryophytes *Neckera complanata* (Hedw.) Huebener and *Palamocladium euchloron* (Bruch ex Müll. Hal.) Wijk & Margad.

Habitat and distribution: The species grows on soil in the *Carpinus* and *Alnus* forests, on tree bases, stone, dead wood, and rotten timbers, and often dominates with *Neckera complanata*, *Leucodon sciuroides* and *Palamocladium euchloron* in Iran. A widespread species in pine and deciduous forests across Asia, Europe, and North America, can also be found at a height range between 500 and 2400 meters. *Sciuro-hypnum curtum* is reported in Bulgaria, France, Italy, Romania, Slovenia, Spain, Germany, Poland, Sweden, Belarus, Ukraine, Estonia, Canada, and the U.S.A. (Nyholm 1965, Orgaz & al. 201, Ignatov & Milyutina 2007, Sabovljevic' & al. 2008, Spitale 2015).

DISCUSSION

Sciuro-hypnum has five species in the flora of Iran including *S. reflexum*, *S. plumosum*, *S. populeum*, *S.*

oedipodium, and *S. flotowianum* (Kurschner & Frey, 2011; Zare & al., 2011). The morphological characteristics of the Iranian species of the genus are compared in Table 1. *Sciuro-hypnum curtum* has not previously been reported in the flora of Iran, we report it for the first time from Rezvanshahr countryside. *Sciuro-hypnum curtum* has similarities in some morphological traits with species such as *S. oedipodium*, *S. starkei*, and *Brachythecium rutabulum* which is discussed below. It is found in habitats similar to where *S. oedipodium* and *S. starkei* might be expected to live. In North American and some other herbaria, *S. oedipodium*, and *S. curtum* are still recognized under '*Brachythecium starkei*'. *Sciuro-hypnum curtum* and *S. oedipodium* are relatively large plants, while *S. starkei* is a medium-sized moss. *Sciuro-hypnum curtum* with rather remotely arranged leaves, that are patent and stem leaves are broadly ovate below and are broadest at 1/7–1/10 of leaf length. Leaves in *S. oedipodium* are ovate, but compared with *S. curtum* are not that broad and usually have the broadest point at 1/6–1/7 of leaf length. In *S. starkei* stem leaves are lanceolate-triangular to ovate-triangular, gradually tapered to apex or sometimes shortly acuminate above, narrowly decurrent.

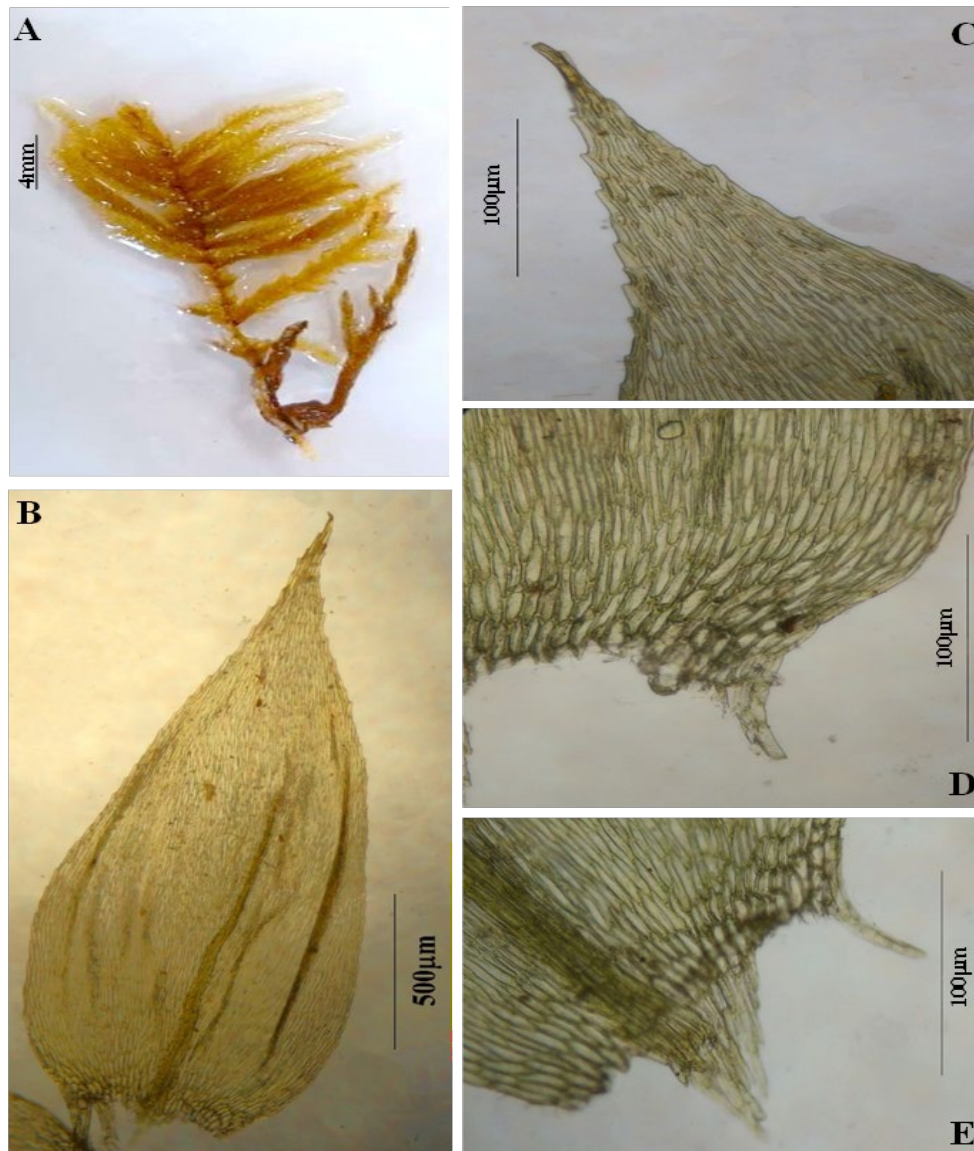


Fig. 2. A, Habit of *Sciuro-hypnum curtum* (Lindb.) Ignatov; B- C, Leaf apex cells; D-E: leaf base cells.

Cells in the *S. curtum* in leaf corners are enlarged, thin-walled, and thus pellucid, gradually or rather abruptly delimited from laminal and basal juxtacostal cells. However, cells in the *S. oedipodium* in the leaf corner are subquadrate to shortly rectangular, slightly enlarged, rather numerous along the margin to the broadest point of the leaf, with normally thickened cell walls, thus the alar group is conspicuous, usually very gradually transforming into laminal and basal juxtacostal cells. Also, alar cells in the *S. starkei* are enlarged and thin-walled, forming a pellucid group just proximal to the decurrency. *S. curtum* has branch leaves

that are usually strongly serrated, but *S. oedipodium* branch leaves are usually serrulate. Capsule in the *S. curtum* is relatively long while in *S. oedipodium* and *S. starkei* is relatively short (Ignatov & Milyutina, 2007). Furthermore, *S. curtum* has often been confused with *B. rutabulum* due to similarities in the appearance of the leaves. Leaves in *B. rutabulum* (Hedwig) Schimper are ovate-cordate, alar cells gradually differentiated from enlarged basal cells, not forming distinct auricles. The specimens from dry habitats of northern Iran, with strongly denticulate leaves, are described as var. *meridionale* by Schiffner (1908).

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Table 1. Comparison of morphological characteristics of the Iranian species of *Sciuro-hypnum*.

Characters	<i>S. curtum</i>	<i>S. reflexum</i>	<i>S. populeum</i>	<i>S. plumosum</i>	<i>S. flotowianum</i>	<i>S. oedipodium</i>
Stems	prostrate or arching, to 10 cm, somewhat flexuose, terete foliate	prostrate to arching, 3-6 cm, terete foliate	Prostrate, to 5 cm, straight to slightly flexuose, rather densely to rather loosely foliate	prostrate, to 5 cm long, rather densely foliate	prostrate, to 5 cm long, rather densely foliate, irregularly branched, branches terete foliate, to 6 mm long, but often most branches are sympodial, with indefinite growth.	Stems to 7 cm, ascending, arching, often curved distally, terete foliate, irregularly pinnate
Branches	branches to 10 mm, usually flattened as moist by the leaves protruding in two directions, and as dry straight or slightly curved.	branches 5-10 mm, not flattened, and as dry heavily bent.	branches to 7 mm, not flattened, and as dry straight or slightly curved.	branches to 6 mm, terete foliate,		branches to 7 mm, often curved, terete foliate.
Stem leaves	Stem leaves more or less protruding, flat or slightly curved, and straight or with a slightly curved upper part, 1.4-2.4 x 0.8- 1.5 mm, ovate to ovate heart-like.	Stem leaves erect or sometimes protruding at the base, while the upper part of the leaves is barred or bent back, 1.0-2.0 x 0.5-1.2 mm, flat or slightly cupped, heart-shaped to ovate.	Stem leaves erect, protruding, curved, straight or slightly curved, 1.2-2.0 x 0.4-0.6 (-0.8) mm, narrowly ovate to ovate triangular.	Stem leaves more or less protruding, cupped, and straight or slightly curved, 1.4-2.0 x 0.4-0.9 mm, ovate to triangular or oblong-ovate. margin finely serrulate in the stem leaves, serrate or strongly serrate in the branch leaves	Stem leaves erect-appressed to erect, densely to moderately imbricate, straight, 1.2-1.9 x 0.35- 0.85 mm, ovate to lanceolate. margin serrulate to serrate, recurved at places, often at a considerable distance	Stem leaves erect, imbricate, or sometimes erectopatent, 1.3-2.3 x 0.7-1.1 mm, ovate, widest at 1/5-1/ 9 of leaf length, acuminate, gradually rounded to base.
Leaf margin	margin plane or recurved below, serrate in the stem leaves, and strongly serrate in the branch leaves.	margin plane or recurved at places, serrulate in the stem leaves	margin plane or recurved just above leaf insertion, margin serrate in both stem and branch leaves	margin finely serrulate in the stem leaves, serrate or strongly serrate in the branch leaves	margin serrulate to serrate, recurved at places, often at a considerable distance	margins plane or often recurved below the broadest part of the leaf, serrulate
Costa	simple and weak sometimes ends in small teeth dorsally on the back, reaches 0.4-0.75 of leaf length, 40 µm wide at the base.	simple and sometimes ends in a point on the back. The costa ends near the tip of the leaf, reaching 0.8-1.0 of leaf length, 40-50 µm wide at the base.	simple and smooth. The costa ends near the leaf tip, to 0.8-1.0 of leaf length, 40-60 µm wide at the base.	simple and smooth or rarely ends in a small point on the back. The costa reaches 0.35-0.65 of leaf length, 35-60 µm wide at the base.	to 0.75-0.95 of leaf length, 50-75 µm wide at the base, remains quite wide almost throughout, ending in a spine	moderately weak, reaching 0.55-0.75 of leaf length, ending without spine, margin slightly serrulate

Table 1. Continued.

Characters	<i>S. curtum</i>	<i>S. reflexum</i>	<i>S. populeum</i>	<i>S. plumosum</i>	<i>S. flotoianum</i>	<i>S. oedipodium</i>
Leaf cells	laminal cells linear, 70-140 x 8-12 μ m	laminal cells 25-60 (-95) x 6-12 μ m.	laminal cells 25-73 x 6-9.5 μ m	laminal cells 30-94 x 5-8.5 μ m.	laminal cells 45-75 x 6-8 μ m,	laminal cells 50-100 x 8-12 μ m
Branch leaves	Branch leaves usually closely imbricate, narrowly ovate to lanceolate	Branch leaves are markedly smaller and narrower than the stem leaves	Branch leaves smaller, margin more strongly serrate.	Branch leaves smaller, ovate, often asymmetric at the base	branch leaves not falcate	Branch leaves smaller, gradually acuminate, decurrent
Seta	Seta 8-13 mm, rough.	Seta 8-15 mm, rough.	Seta 12-24 mm, rough, but sometimes weakly so.	Seta 17-32 mm, rough.		reddish-orange, 15-20 mm, er indistinctly
Capsule	inclined to horizontal, ovate-cylindric, 1.0-1.5 mm long	slightly to moderately inclined, slightly dorsally, 1.3-1.5 mm long	slightly to moderately inclined, ovate, 1.3-2.0 mm long	oblong, horizontal to pendent, curved, ca. 2.0 mm long	reddish brown, inclined, ovate to oblong, 1.4-1.8 mm long.	reddish-orange, inclined to horizontal, ca. 1.2-1.5 mm long.
spores	13-18 μ m.	11-21 μ m	12-16 μ m	14-19 μ m	14-18 μ m	13-16 μ m.
Sexual generation	Autoicous	Autoicous	Autoicous	Autoicous	Dioicous	Autoicous
Location	Guilan, 581m	Rezvanshahr, Mazandaran, Nowshahr, 2400m	Mazandaran, Nowshahr, 1650m Guilan, Rezvanshahr, 910m	100- Mazandaran, Haraz-Valley, Kareh sang.	Mazandaran, Nowshahr, 100-1500m Guilan, Rezvanshahr, 100-1000m	Not specified